

Nalco Docket No.: 7560-NES
Customer No. 000049459

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CLAIMS

1. (currently amended) A polymeric composition comprising ~~the~~ oligo-and polymeric reaction products of an amine having two reactive amino hydrogens selected from the group consisting of 2-(2-aminoethoxy) ethanol and tris(hydroxymethyl)aminomethane and mixtures thereof; and a glycidyl ether compound selected from the group consisting of diglycidyl ethers of aliphatic diols, triglycidyl ethers of aliphatic triols, and tetraglycidyl ethers of aliphatic polyols, or mixtures thereof.
2. (currently amended) The polymeric composition of claim 1 ~~further comprising~~ the oligo-and polymeric reaction products of an amine having two reactive amino hydrogens selected from the group consisting of 2-(2-aminoethoxy) ethanol and tris(hydroxymethyl)aminomethane and mixtures thereof; a second amine monomer having two reactive amino hydrogens and a tertiary amine group; and a glycidyl ether compound selected from the group consisting of diglycidyl ethers of aliphatic diols, triglycidyl ethers of aliphatic triols, and tetraglycidyl ethers of aliphatic polyols, or mixtures thereof.
3. (currently amended) The polymeric composition of claim 2 further comprising an amine capping monomer, having one or two reactive amino hydrogens, reacted with terminal epoxy groups of the oligo-and polymeric reaction products.
4. (original) The polymeric composition of claim 3 wherein the amine capping monomer is selected from the group consisting of diethanolamine, N,N,N'-(trimethyl)-1,3-propanediamine, N-Methyl-D-glucamine and mixtures thereof.
5. (currently amended) The polymeric composition of claim 2 wherein the diglycidyl ether of an aliphatic diol is selected from the group consisting of the diglycidyl ether of neopentyl glycol, diglycidyl ether of 1,4 butanediol, diglycidyl ether of ethylene glycol, diglycidyl ether of polyethylene glycol having a number average molecular weight, M_n , of about 526, and mixtures thereof, and the second amine monomer is (dimethylamino)-propylamine.

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL

6. (currently amended) The polymeric composition of claim 4 further comprising an N-alkylating agent reacted with amine groups of the oligo-and polymeric reaction products.
7. (currently amended) The polymeric composition of claim 6 wherein the N-alkylating agent is an epihalohydrin-~~containing group~~reacted polyalkoxide.
8. (currently amended) The polymeric composition of claim 7 wherein the ~~halogen~~ epihalohydrin is ~~ehlorine~~ epichlorohydrin.
9. (original) The polymeric composition of claim 6 wherein the N-alkylating agent further comprises a polyoxyalkylene group.
10. (currently amended) The polymeric composition of claim 9 wherein the polyoxyalkylene group is selected from the group consisting of polyethoxy-~~containing~~ groups, polypropyloxy-~~containing~~ groups and mixtures thereof.
11. (original) The polymeric composition of claim 10 wherein the polyoxyalkylene group has a propoxy to ethoxy ratio of from 9 to 1 to about 1 to 9.
12. (original) The polymeric composition of claim 9 wherein the polyoxyalkylene group is methoxy-capped polyethylene oxide.
13. (original) The polymeric composition of claim 6 wherein the N-alkylating agent ~~containing group~~ is an epichlorohydrin capped polyoxyalkylene glycol methyl ether.
14. (original) The polymeric composition of claim 6 further comprising at least one C₁ to C₁₆ alcohol and at least one acid-containing compound.
15. (currently amended) A polymeric composition comprising: the oligo-and polymeric reaction products of a first amine-containing monomer having two reactive amino hydrogens, a second amine-containing monomer having two reactive amino hydrogens and at least one tertiary amine group, and a diglycidyl ether of an aliphatic diol.

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL

16. (previously presented) The polymeric composition according to claim 15 wherein an amine capping monomer having one or two reactive amino hydrogens is subsequently reacted with terminal epoxy groups on the ~~linear~~ oligo- and polymeric reaction products.
17. (original) The polymeric composition according to claim 16 wherein the amine capping monomer is selected from the group consisting of diethanolamine, N, N, N'- (trimethyl)-1,3-propanediamine, N-methyl-D-glucamine and mixtures thereof.
18. (currently amended) The polymeric composition according to claim ~~17~~ 16 wherein the amine capping monomer further comprises at least one tertiary amine group.
19. (currently amended) The polymeric composition according to claim 18 further comprising an N-alkylating agent ~~containing group~~ reacted with amine groups of the oligo- and polymeric reaction products.
20. (currently amended) The polymeric composition according to claim 19 wherein the N-alkylating agent comprises an epihalohydrin ~~containing group~~ reacted polyalkoxide.
21. (currently amended) The polymeric composition according to claim 20 wherein the ~~halo-group~~ epihalodrin is chlorine or bromine epichlorohydrin or epibromohydrin.
22. (original) The polymeric composition according to claim 19 wherein the N-alkylating agent containing group further comprises a polyoxyalkylene group.
23. (currently amended) The polymeric composition according to claim 22 wherein the polyoxyalkylene group is selected from polyethoxy ~~containing~~ groups, polypropyloxy ~~containing~~ groups and mixtures thereof.
24. (original) The polymeric composition according to claim 22 wherein the polyoxyalkylene group is methoxy capped polyethylene oxide.
25. (original) The polymeric composition according to claim 19 wherein the N-alkylating agent containing group is an epichlorohydrin capped polyoxyalkylene glycol methyl ether.

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL

26. (original) The polymeric composition according to claim 19 further comprising at least one C₁ to C₁₆ alcohol and at least one acid-containing compound.
27. (original) The polymeric composition according to claim 15, wherein the diglycidyl ether of an aliphatic diol is selected from the group consisting of the diglycidyl ether of neopentyl glycol; the diglycidyl ether of butanediol; the diglycidyl ether of ethylene glycol; the diglycidyl ether of polyethylene glycol and mixtures thereof; and the second amine monomer is N, N-dimethylamino propylamine.
28. (currently amended) A polymeric composition comprising, the oligo- and polymeric reaction products of an amine having two reactive amino hydrogens, and an epoxidized olefin having two epoxide groups, and a second amine monomer having two reactive amino hydrogens and a tertiary amine group.
29. (currently amended) The polymeric composition according to claim 28, ~~further comprising a subsequently reacted~~ wherein an amine capping monomer having one or two reactive amino hydrogens wherein said capping monomer is reacted with epoxy groups of the oligo- and polymeric reaction products.
30. (original) The polymeric composition according to claim 29 wherein the amine capping monomer further comprises at least one tertiary amine group.
31. (currently amended) The polymeric composition according to claim 30 ~~further comprising~~ the oligo- and polymeric reaction products of an amine having two reactive amino hydrogens, an epoxidized olefin having two epoxide groups, a triglycidyl ether of an aliphatic triol, and a second amine monomer having two reactive amino hydrogens and a tertiary amine group.
32. (currently amended) The polymeric composition according to claim 29 further comprising an N-alkylating agent reacted with amine groups of the oligo- and polymeric reaction products.
33. (currently amended) The polymeric composition according to claim 32 wherein the N-alkylating agent is an epihalohydrin-~~containing group~~ reacted polyalkoxide compound.

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL

34. (currently amended) The polymeric composition according to claim 33 wherein the ~~halogen~~ epihalodrin is chlorine or bromine epichlorohydrin or epibromohydrin.
35. (original) The polymeric composition according to claim 32 wherein the N-alkylating agent further comprises an oxyalkylene group.
36. (original) The polymeric composition according to claim 35 wherein the oxyalkylene group is a polyoxyalkylene wherein the polyoxyalkylene group is selected from polyethoxy-~~containing~~ groups, polypropyloxy-~~containing~~ groups or mixtures thereof.
37. (original) The polymeric composition according to claim 36 wherein the polyoxyalkylene group has a propoxy to ethoxy ratio of from 9 to 1 to about 1 to 9.
38. (currently amended) The polymeric composition according to claim 32 wherein the N-alkylating agent ~~containing group~~ is an epichlorohydrin capped polyoxyalkylene glycol methyl ether.
39. (original) The polymeric composition according to claim 35 wherein the polyoxyalkylene group is methoxy-capped polyethylene oxide.
40. (original) The polymeric composition according to claim 32 further comprising at least one C₁ to C₁₆ alcohol and at least one acid-containing compound.
41. (canceled)

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL

42. (currently amended) A polymeric composition comprising the reaction product of at least one first amine having two reactive hydrogens, selected from the group consisting of methylamine, ethylamine, propylamine, butylamine, sec-butylamine, isobutylamine, 3,3-dimethylbutylamine, hexylamine and benzylamine, 2-amino-1-butanol, 4-amino-1-butanol, 2-amino-2-methyl-1-propanol, 6-amino-1-hexanol, ethanolamine, propanolamine, tris(hydroxymethyl) aminomethane, D-glucamine, 3-amino-1,2-propanediol, 2-amino-2-methyl-1,3-propanediol, 2-amino-2-ethyl-1,3-propanediol, 3-(dimethylamino)propylamine, N,N-dimethylethylenediamine, N,N-diethylethylenediamine, 1-(2-aminoethyl)piperidine, 4-(2-aminoethyl)morpholine, 2-(2-aminoethyl)-1-methylpyrrolidine, 1-(2-aminoethyl)pyrrolidine, 2-(2-aminoethyl)pyridine, 2-(2-aminoethylamino)ethanol, piperazine, 2-methyl piperazine, 2,6-dimethylpiperazine, 2-(methyramid) piperazine, N,N'-bis(2-hydroxyethyl)ethylenediamine, N,N'-dimethylethylenediamine, N,N-dimethyl-1,4-phenylenediamine and N,N'-dimethyl-1,6-hexanediamine;

(b) at least one second amine having two reactive amino hydrogens and a tertiary amine group selected from the group consisting of 3-(dimethylamino)propylamine, N,N-dimethylethylenediamine, N,N-diethylethylenediamine, 1-(2-aminoethyl)piperidine, 4-(2-aminoethyl)morpholine, 2-(2-aminoethyl)-1-methylpyrrolidine, 1-(2-aminoethyl)pyrrolidine, and 2-(2-aminoethyl)pyridine;

(c) at least one diepoxy-containing compound said diepoxy compound selected from the group consisting of: bis(2,3-epoxypropyl)ether, diglycidyl ether of 1,4-butanediol, diglycidyl ether of neopentyl glycol, diglycidyl ether of ethylene glycol, glycerol diglycidyl ether, diglycidyl ether of polyethyleneglycol, diglycidyl ether of polypropylene glycol, the diglycidyl ether from the reaction product of ethylene oxide with propylene oxide, diglycidyl ester of cyclohexane dimethanol and diglycidyl ester of a dimer acid, 1,2,3,4-diepoxybutane; 1,2,7,8-diepoxyoctane, 1,2,9,10-diepoxydecane and 1,2,5,6-diepoxycyclooctane;

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL

(d) at least one amine capping monomer having one or two reactive amino hydrogens, wherein said capping monomer is reacted with terminal epoxy groups, the amine capping monomer being selected from the group consisting of diethanolamine, diisopropanolamine, N-methyl-D-glucamine, N-methylpropylamine, dimethylamine, diethylamine, dipropylamine, diisopropylamine, N,N,N'-trimethyl-1,3-propanediamine, N,N,N'-trimethylethylenediamine, N,N-dimethyl-N'-ethylethylenediamine, N,N,N'-triethylethylenediamine; and

(e) at least one N-alkylating epichlorohydrin capped polyalkylene glycol methyl ether having the following formula:

$R_8-O-[CH_2-CH(R_9)-O]_n-CH_2-CH(OH)-CH_2-X$ where:

R_8 is hydrogen, C_1 to C_6 alkyl, C_6 - C_{10} aryl, 2-hydroxy-3-chloropropyl, or 2,3-oxopropyl,

R_9 is hydrogen, or C_1 to C_6 alkyl,

X is a halogen atom, and n in the range of 1 to 120.

43. (previously presented) The polymeric composition according to claim 42, further comprising the polymeric reaction product of an amine having two reactive amino hydrogens selected from the group consisting of: 2-(2-aminoethoxy) ethanol; $CH_3OCH_2CH_2O[CH(-CH_3)CH_2O]_nCH_2CH(-NH_2)CH_3$ where n is at least one; $CH_3-O-(CH_2CHR-O)_n-CH_2CH(-CH_3)NH_2$ where n is at least one; $CH_3O(CH_2CH_2O)_n-(CH_2CHR-O)_n-CH_2-CH(-CH_3)-NH_2$, where R is H or CH_3 and n is such that the overall $-CH_2CH_2-O-$ to $-CH_2-CH(-CH_3)O-$ ratio is 70/30; and $H_2N-CH_2CH_2OCH_2CH_2-OH$, a diepoxy-containing compound, and a triepoxy-containing compound.

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL

44. (currently amended) A polymeric composition comprising oligo-and polymeric reaction products of

(a) a first amine having two reactive amino hydrogens is selected from the group consisting of: ethanolamine, propanolamine, and polyoxyalkylamines according to the formula

$R_4-(CH_2CH(R_5)O)_n-CH_2CH(CH_3)NH_2$, where R_4 is $-OCH_3$, R_5 is hydrogen or $-CH_3$, and n is 1 to 45, 2-(2-aminoethylamino)ethanol, piperazine, N,N-bis(2-hydroxyethyl)ethylenediamine, and N,N'-dimethylethylenediamine and mixtures thereof;

(b) a diepoxy compound selected from the group consisting of diglycidyl ether of 1,4-butanediol, diglycidyl ether of neopentyl glycol, diglycidyl ether of ethylene glycol, diglycidyl ether of polyethyleneglycols, 1,2,3,4-diepoxybutane, 1,2,7,8-diepoxyoctane and mixtures thereof;

(c) an amine capping monomer having one or two reactive amino hydrogens subsequently reacted with terminal epoxy groups, selected from the group consisting of diethanolamine, N-methyl-D-glucamine, N-methylpropylamine, N,N,N'-trimethyl-1,3-propanediamine, N,N,N'-trimethylethylenediamine, and mixtures thereof, and;

(d) an N-alkylating epichlorohydrin capped polyalkylene glycol methyl ether-containing group having the formula:



where n is 100 to 113 and R_9 is selected from the group consisting of hydrogen and a C_1 to C_6 alkyl group.

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL

45. (currently amended) The polymeric composition according to claim 44, wherein (a) further comprising comprises a second amine monomer having two reactive amino hydrogens and a tertiary amine group selected from the group consisting of 3-(dimethylamino)propylamine, N,N-dimethylethylenediamine, and mixtures thereof.
46. (original) The polymeric composition according to claim 44, further comprising at least one C₁ to C₁₆ alcohol and at least one acid-containing compound.
47. (original) The polymeric composition according to claim 46 further comprising an effective amount of a compound selected from the group consisting of alkyleneoxide copolymers, oxyalkylated alcohols, organo-phosphate esters, inorganic phosphate esters, polyglycols, resole resins, novalac resins and mixtures thereof.
48. (original) The polymeric composition according to claim 46 further comprising, an acid selected from the group consisting of arylalkylsulfonic acid; aqueous hydrochloric acid, hydrofluoric, sulfamic, acetic acid, formic acid, nitric acid, citric acid, ethylenediaminetetraacetic acid, nitriloacetic acid and mixtures thereof.
49. (original) A method of treating an oil bearing formation comprising the steps of: charging an oil bearing formation with an effective amount of a demulsifier or demulsifier composition according to claim 46 blended per 1000 gallons of an aqueous organic or aqueous inorganic acid solution.
50. (original) The method of treating an oil bearing formation according to claim 49 wherein the effective amount of demulsifier is in the range of 0.01 to about 5 gallons per 1000 gallons of an added aqueous acidic solution.

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL

51. (currently amended) A method of preparing a polymeric demulsifier compound comprising the steps of:
- a) providing a first amine monomer having two reactive amino hydrogens;
 - b) reacting the amine monomer with a an aliphatic or cycloaliphatic monomer comprising at least two glycidyl groups or at least two epoxide groups to provide a polymeric reaction product;
 - c) capping unreacted glycidyl or epoxy groups on the polymeric reaction product with an amine monomer having two reactive amino hydrogens and a tertiary amine group; and
 - d) alkylating amine groups on the polymeric reaction product with a N-alkylating agent-containing group to provide a polymeric demulsifier compound.
52. (previously presented) The method of claim 51 further comprising the step of adding a second amine monomer having two reactive amino hydrogens and a tertiary amine group to the reaction.
53. (original) The method of claim 51 wherein the first amine monomer is elected from the group consisting of 2-(2-aminoethoxy) ethanol; $\text{CH}_3\text{OCH}_2\text{CH}_2\text{O}[\text{CH}(\text{CH}_3)\text{CH}_2\text{O}]_n\text{CH}_2\text{CH}(\text{NH}_2)\text{CH}_3$ where n is at least one; $\text{CH}_3-(\text{CH}_2\text{CHRO})_n-\text{CH}_2\text{CH}(\text{CH}_3)\text{NH}_2$ where n is at least one; $\text{CH}_3\text{O}(\text{CH}_2\text{CH}_2\text{O})_n-(\text{CH}_2\text{CRHO})_n-\text{CH}_2-\text{CH}(\text{CH}_3)-\text{NH}_2$, where R is H or CH_3 , and n is such that the ratio of $-\text{CH}_2\text{CH}_2\text{O}$ to $-\text{CH}_2\text{CH}(\text{CH}_3)$ is 70/30.
54. (previously presented) The method of claim 51 further characterized by reacting 0.5 to 1.4 moles of amines having two reactive amino hydrogens with 1.0 mole of a diglycidyl ether of a glycol or epoxidized olefin and heating the reactants to between 25 °C to 240 °C for a period of time sufficient for the reaction product to attain a viscosity of at least 80,000 cps.

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL

55. (previously presented) The method of claim 51, further characterized by reacting 0.7 to 1.2 moles of at least one amine having two active amino hydrogens, and a second amine monomer having two reactive amine hydrogens and a tertiary amine group with one mole of diglycidyl ether of a glycol or epoxidized olefin between 25 °C to 240 °C for a time period sufficient for the reaction product to reach a viscosity of at least 80,000 cps.
56. (original) The method of claim 51 further characterized by grafting an N-alkylating agent onto the polymer by reacting the polymer and N-alkylating agent a weight ratio of between 1:1 to 8:1 at a pH between 7.5 and 9.0 at a temperature between 60 °C and 95 °C for a time period sufficient to reach a solution viscosity between 200 and 9000 cps.
57. (original) The method of claim 51 further characterized by grafting the N-alkylating agent onto the polymer at a weight ratio of between 1:1 to 8:1 of polymer to N-alkylating agent, at a pH between 7.5 and 9.0 and at a temperature between 85 °C and 95 °C for a time sufficient to produce a viscosity between 200 and 5000 cps.
58. (original) The method of claim 51 wherein the N-alkylating agent is epichlorohydrin capped polyalkylene glycol methyl ether.
59. (original) The method of claim 51 further comprising the step of protonating the polymeric reaction product after steps b and c with an acid.

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL

60. (currently amended) A polymeric composition comprising the polymeric reaction product of

1) at least one first amine-containing group having two reactive amino hydrogens selected from the group consisting of

(a) methylamine, ethylamine, propylamine, butylamine, sec-butylamine, isobutylamine, 3,3-dimethylbutylamine, hexylamine, benzylamine, 2-amino-1-butanol, 4-amino-1-butanol, 2-amino-2-methyl-1-propanol, 6-amino-1-hexanol, ethanolamine, propanolamine, tris(hydroxymethyl)aminomethane, 1-amino-1-deoxy-D-sorbitol (D-glucamine), 3-amino-1,2-propanediol, 2-amino-2-methyl-1,3-propanediol, 2-amino-2-ethyl-1,3-propanediol, 3-(dimethylamino)propylamine, N,N-dimethylethylenediamine, N,N-diethylethylenediamine, 1-(2-aminoethyl)piperidine, 4-(2-aminoethyl)morpholine, 2-(2-aminoethyl)-1-methylpyrrolidine, 1-(2-aminoethyl)pyrrolidine, 2-(2-aminoethyl)pyridine, 2-(2-aminoethylamino)ethanol, piperazine, 2-methyl piperazine, 2,6-dimethylpiperazine and 2-(methyldamido)piperazine, N,N'-bis(2-hydroxyethyl)ethylenediamine, N,N'-dimethylethylenediamine, N,N'-dimethyl-1,4-phenylenediamine and N,N'-dimethyl-1,6-hexanediamine;

(b) amines of formula $\text{NH}_2\text{-R1-Z1}$; and

(c) amines of formula $\text{HN (R1Z1)-R3-NH- (R1Z1)}$;

wherein R1 is $(\text{-CH}_2\text{-CH}_2\text{-O-})_n$, $(\text{-CH}_2\text{-CH}(\text{-CH}_3)\text{-O-})_n$, or $(\text{-CH}_2\text{-CH}_2\text{-O-})_m\text{-(CH}_2\text{CH}(\text{-CH}_3)\text{-O-})_p$ where n, m and p are 1 to 45; R3 is a $\text{C}_2\text{-C}_{20}$ alkylene or $\text{C}_2\text{-C}_{20}$ substituted alkylene wherein the substituent are selected from the group consisting of alkylamido, hydroxy, alkoxy, halo, cyano, aryloxy, alkylcarbonyl, arylcarbonyl, and mixtures thereof; and Z1 is hydrogen, alkyl or acyl;

2) at least one diepoxy-containing compound selected from compounds of formula: Epoxy- $\text{CH}_2\text{-O-(R6-O)}_n\text{-CH}_2\text{-Epoxy}$; and Epoxy- $\text{CH}_2\text{-R7-CH}_2\text{-Epoxy}$

wherein R6 is selected from C_2 to C_{20} alkylene; alkyl substituted C_2 to C_{20} alkylene, C_2 to C_{40} alkoxy, and C_2 to C_{40} hydroxy substituted alkoxy; n is 0 to 20; and R7 is a C_2 to C_{20} alkylene, or a substituted alkylene; and

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL

3) at least one N-alkylating agent selected from the group consisting of epihalohydrin capped polyalkylene glycol methyl ether of formula
$$R8-O-[CH_2-CH(R9)-O]_n-CH_2-CH(OH)-CH_2-X$$

wherein R8 is selected from hydrogen, C₁-C₆ alkyl, C₆-C₁₀ aryl, 2-hydroxy-3-chloropropyl and 2,3-oxopropyl; R9 is selected from hydrogen and C₁ to C₆ alkyl; n is 1 to 120; and X is a halogen atom.